MODEL GD-97 Utility Transmitter

HEATHKIT®

ASSEMBLY MANUAL

HEATH COMPANY • BENTON HARBOR, MICHIGAN

Model GD-97 Utility Transmitter

HEATHKIT®

RUSH

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595-980-04

Dear Customer:

The Heathkit electronic product you have purchased is one of the best performing electronic products in the world.

Here's how we aim to keep it that way:

Your Heathkit Warranty

During your first 90 days of ownership, any parts which we find are defective, either in materials or workmanship, will be replaced or repaired free of charge. And we'll pay shipping charges to get those parts to you — anywhere in the world.

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This protection is exclusively yours as the original purchaser. Naturally, it doesn't cover damage by use of acid-core solder, incorrect assembly, misuse, fire, flood or acts of God. But, it does insure the performance of your Heathkit electronic product anywhere in the world — for most any other reason.

After-Warranty Service

What happens after warranty? We won't let you down. If your Heathkit electronic product needs repairs or you need a part, just write or call the factory, your nearest retail Heathkit Electronic Center, or any Heath authorized overseas distributor. We maintain an inventory of replacement parts for each Heathkit model at most locations — even for many models that no longer appear in our current product line-up. Repair service and technical consultation are available through all locations.

We hope you'll never need our repair or replacement services, but it's nice to know you're protected anyway — and that cheerful help is nearby.

Sincerely,

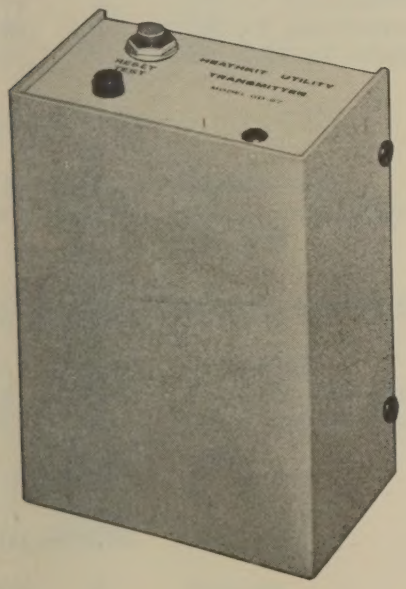
HEATH COMPANY
Benton Harbor, Michigan 49022

Assembly
and
Operation
of the

HEATHKIT

UTILITY TRANSMITTER

MODEL GD-97



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HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

INTRODUCTION

The Heathkit Utility Transmitter, Model GD-97, can be used with several different types of sensors to provide you with a complete alarm service. These sensors may be used either individually or combined to act as a fire alarm, intrusion alarm, flood alarm, or to warn you of thawing or cooling in farming and food storage applications. A warning signal is also provided in case of certain power supply component failures in the Transmitter or a break in a normally closed sensor wire. This Transmitter is used in conjunction with the Heathkit Home Protection Receiver, Model GD-77; the AC power line is used to carry the warning signals between these two units.

Any type of sensor that will provide either an open circuit or a closed circuit, when activated, can be used with this Transmitter. Any number of sensors may be used. This unit is equipped with a push-to-test switch, and an indicator lamp which indicates when the unit has been triggered. The Utility Transmitter requires very little power to operate and it remains plugged into the AC power line at all times.

These features, combined with solid state circuitry and rugged construction, will provide your home, farm, or business with many years of reliable warning service.

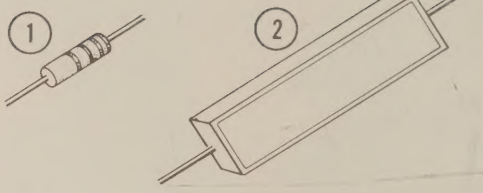
Refer to the "Kit Builders Guide" for complete information on unpacking, parts identification, tools, wiring, soldering, and step-by-step assembly procedures.

PARTS LIST

To order replacement parts, refer to the Replacement Parts Price List and use the Parts Order Form furnished with this kit.

PART No.	PARTS Per Kit	DESCRIPTION
RESISTORS		
(1) 1-9	1	1000 Ω 1/2 watt (brown-black-red)
1-16	1	4700 Ω 1/2 watt (yellow-violet-red)
1-20	1	10 kΩ 1/2 watt (brown-black-orange)
1-102	1	82 kΩ 1/2 watt (gray-red-orange)
(2) 3-15-7	1	1000 Ω (1k) 7 watt
CAPACITORS		
(3) 25-160	1	250 μF electrolytic
25-194	1	100 μF electrolytic
(4) 31-49	1	250-1000 pF trimmer
DIODES		
(5) 57-27	2	Silicon diode
(6) 57-50	1	Silicon controlled rectifier (TIC-44)
FUSEHOLDER-TERMINAL STRIPS-SOCKET		
(7) 422-1	1	Fuseholder
(8) 431-1	1	2-lug terminal strip
(9) 431-17	1	5-lug screw-type terminal strip
(10) 434-147	1	AC socket
METAL PARTS		
(11) 90-399	1	Chassis
(12) 90-400-1	1	Chassis cover
(13) 204-9	2	Small angle bracket
(14) 204-240	1	Large angle bracket

PART No.	PARTS Per Kit	DESCRIPTION
ELECTRICAL		
(15) 54-156	1	Power transformer
89-45	1	Line cord
(16) 150-21	1	50 kHz transmitter module
(17) 64-7	1	SPST pushbutton switch
(18) 69-71	1	DPST relay
(19) 412-15	1	Neon lamp
421-26	1	1/8 ampere slow-blow fuse
HARDWARE		
(20) 250-388	2	#6 x 1-1/2" wood screw
(21) 250-369	4	#6 x 1/4" black sheet metal screw
(22) 250-89	11	6-32 x 3/8" screw
(23) 252-3	8	6-32 nut
(24) 252-7	1	Control nut
(25) 252-32	1	Speednut
(26) 254-1	11	#6 lockwasher
254-4	1	Control lockwasher
(27) 253-10	1	Flat washer
(28) 255-42	1	Fiber spacer
(29) 261-28	4	Plastic foot
WIRE-SLEEVING		
344-50	1	Black wire
344-52	1	Red wire
344-54	1	Yellow wire
344-56	1	Blue wire
346-1	1	Sleeving
MISCELLANEOUS		
(30) 413-10	1	Red lens
85-255-1	1	Circuit board
(31) 75-24	1	Line cord strain relief
490-5	1	Nut starter
597-308	1	Kit Builders Guide
597-260	1	Parts Order Form
597-529	1	Instruction sheet
391-34	1	Blue and white label
	1	Manual (See front cover for part number.)
		Solder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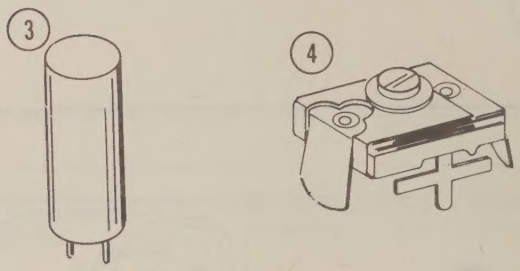
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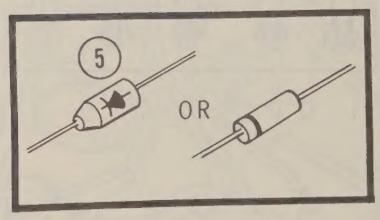
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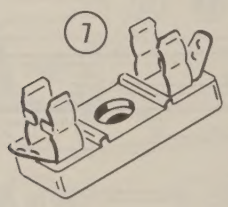
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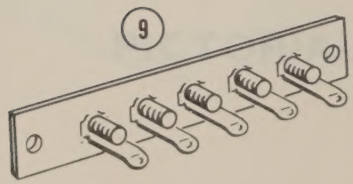
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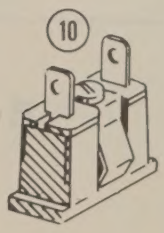
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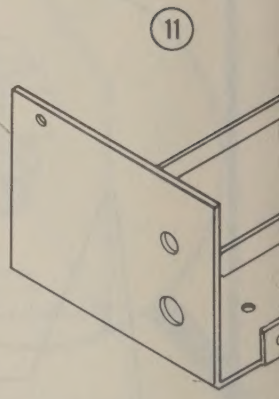
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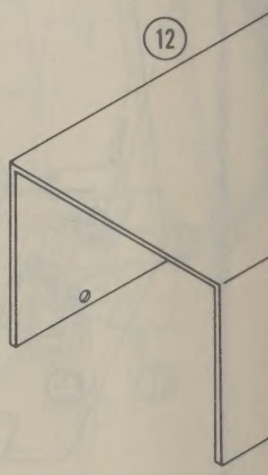
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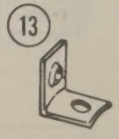
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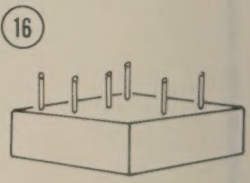
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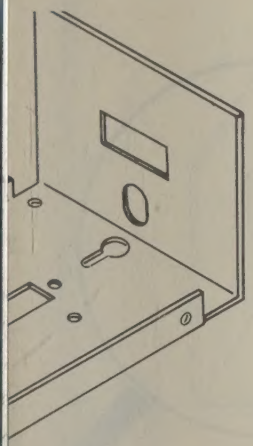
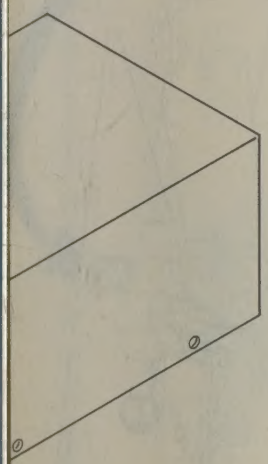
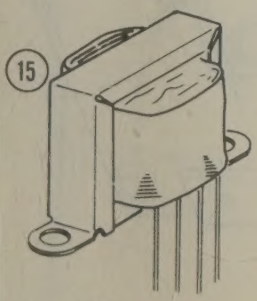
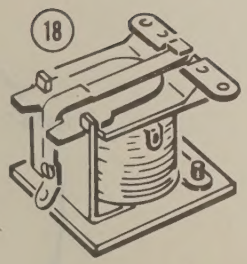
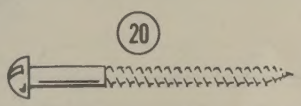
CTORIAL

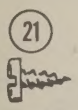


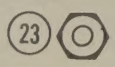


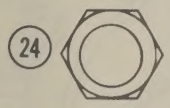


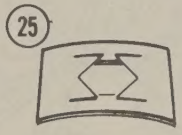


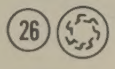


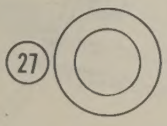


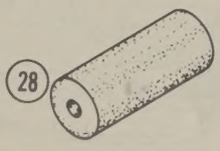


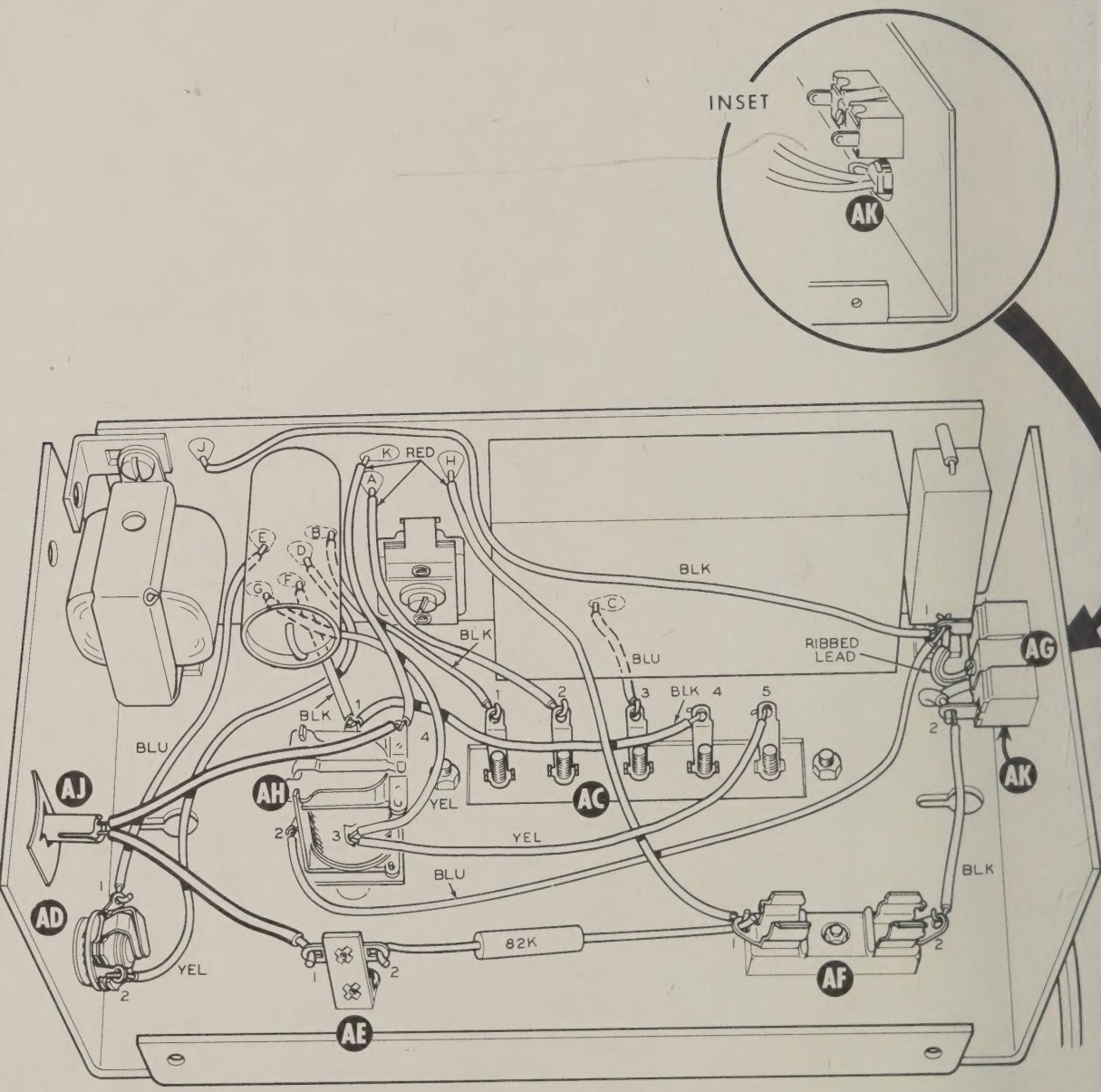








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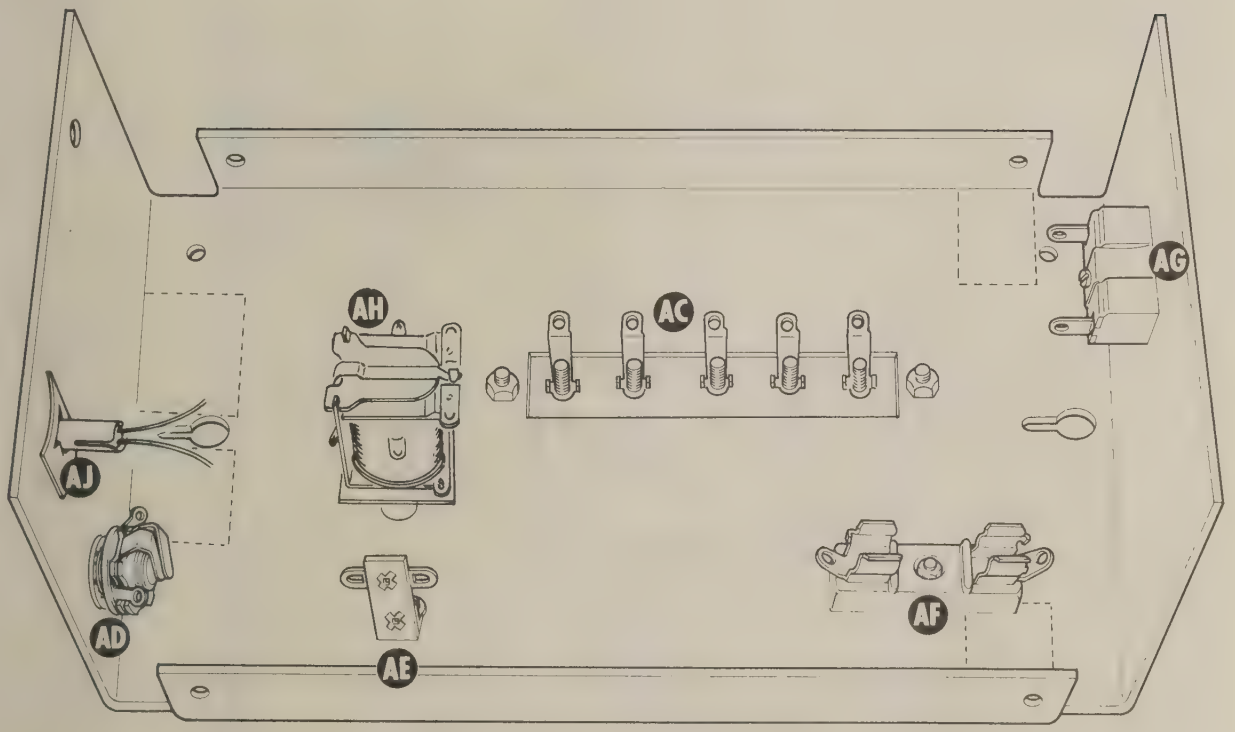
PICTORIAL 5



PICTORIAL 4

STEP-BY-STEP ASSEMBLY

Before starting to assemble this kit, refer to the Kit Builders Guide for complete information on wiring, and step-by-step assembly information.

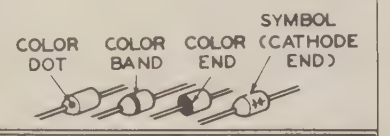
CIRCUIT BOARD ASSEMBLY

Components will be installed on the circuit board by following the steps on Pictorials 1 through 3. Position all parts as they are shown. Resistors will be called out by their resistance value (in Ω or kΩ) and color code. Capacitors will be called out by their capacitance value and type.

START

NOTE: Position the circuit board with the Lettered side up, as shown and complete the following steps.

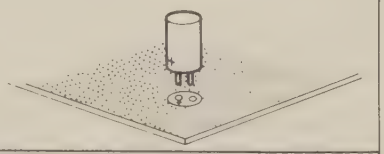
NOTE: When installing the silicon diodes, be sure to position the cathode end as shown. The cathode end will be marked with a color dot, color band, color end or symbol.



( ) Silicon diode (#57-27) D3.

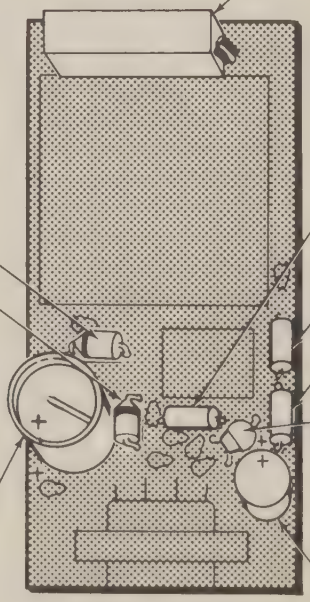
( ) Silicon diode (#57-27) D1.

NOTE: When installing the electrolytic capacitors, position the positive (+) marking on the capacitor with the positive (+) marking on the circuit board.



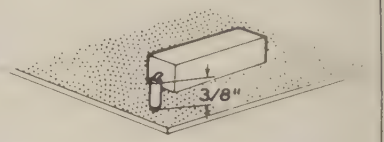
( ) 100 μF electrolytic.

( ) Solder all leads to the foil, and cut off the excess lead lengths.



CONTINUE

( ) Place a 3/8" length of sleeving over each lead of the 1 kΩ 7 watt resistor. Then mount the resistor above the circuit board as shown.

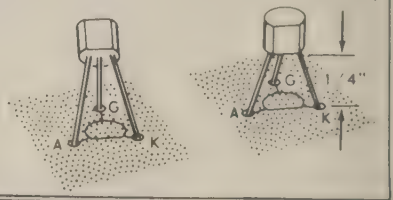


( ) 1000 Ω resistor (brown-black-red).

( ) 4700 Ω resistor (yellow-violet-red).

( ) 10 KΩ resistor (brown-black-orange).

( ) Position the A, G, and K leads of a silicon controlled rectifier into the corresponding A, G, and K holes in the circuit board.



( ) 250 μF electrolytic.

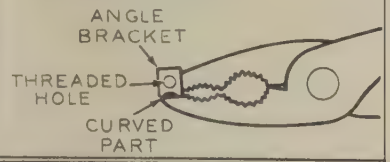
( ) Solder all leads to the foil, and cut off the excess lead lengths.

PROCEED TO PICTORIAL 2

PICTORIAL 1

START

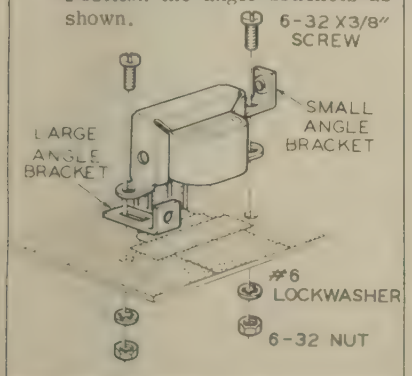
( ) Locate the two small angle brackets. Use a pair of pliers to flatten the curved part of each bracket as shown.

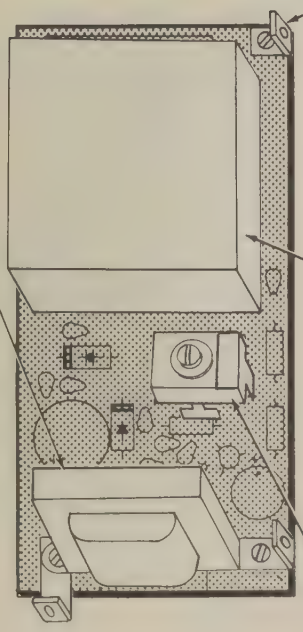


NOTE: The Heath Company has provided a plastic nut starter to hold and start nuts on screws. See Page 3 of The Kit Builders Guide for further information.

( ) Scrape the varnish from the transformer leads where they will pass through the foil on the circuit board. Position the power transformer as shown. Insert the transformer leads in the corresponding holes in the circuit board as shown.

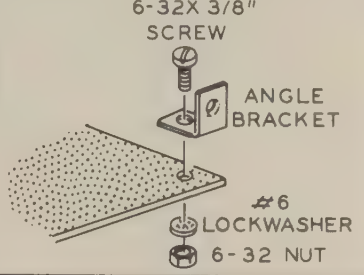
( ) Mount the transformer with a 6-32 x 3/8" screw, A large angle bracket, a #6 lockwasher, and a 6-32 nut at one end. Use a 6-32 x 3/8" screw, a small angle bracket, a #6 lockwasher, and a 6-32 nut at the other end. Position the angle brackets as shown.



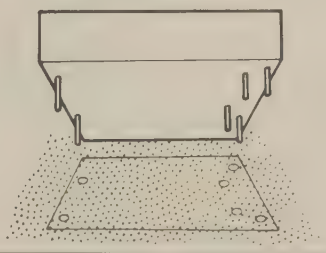


CONTINUE

( ) Mount a small angle bracket with a 6-32 x 3/8" screw, a #6 lockwasher, and a 6-32 nut.

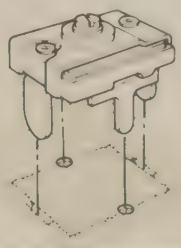


( ) 50 kHz transmitter module. Straighten the pins before mounting.



( ) Solder the transformer and transmitter module leads and cut off the excess lead lengths.

( ) Mount the ceramic trimmer capacitor as shown and solder the lugs to the foil. Be sure all the leaves of each lug are soldered.



PROCEED TO PICTORIAL 3.

PICTORIAL 2

START

Use the ruler printed on the bottom of this Page to measure the lengths of wire in the following step.

( ) Prepare the following lengths of hookup wire. To prepare a wire, cut it to the indicated length and remove 1/4" of insulation from each end.

Color	Length
red	3-1/2"
red	3-1/2"
red	3"
black	5-1/2"
black	3"
blue	3"
blue	2-1/2"
yellow	4"
black	3"
yellow	4"

In the following steps, one end of each wire will be connected to a hole in the circuit board. Install each wire to the component side and solder it to the foil side of the circuit board. Solder each wire as it is installed. The other ends will be connected later.

( ) 3-1/2' red wire to hole H.

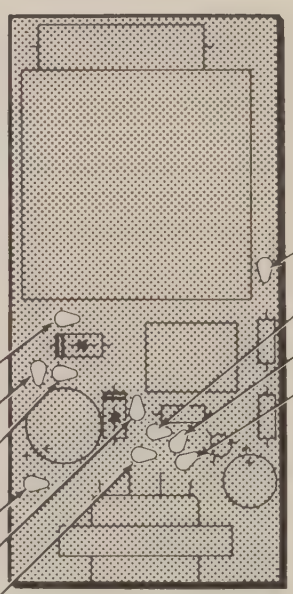
( ) 3-1/2" red wire to hole K.

( ) 3" red wire to hole A.

( ) 5-1/2" black wire to hole J.

( ) 3" black wire to hole B.

( ) 3" blue wire to hole E.



PICTORIAL 3

CONTINUE

( ) 2-1/2" blue wire to hole C.

( ) 4" yellow wire to hole D.

( ) 3" black wire to hole F.

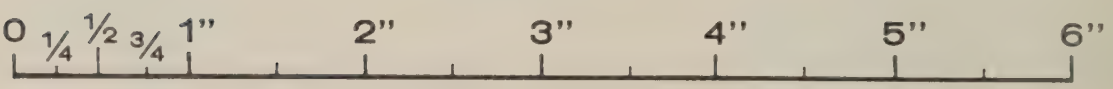
( ) 4" yellow wire to hole G.

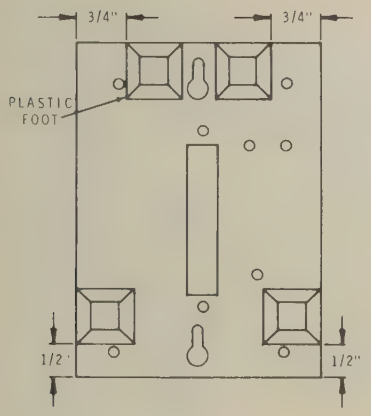
( ) Cut off any excess wire ends on the foil side of the circuit board.

Set the circuit board aside. It will be used later.

FINISH

PROCEED TO PAGE 7





Detail 4A

CHASSIS PARTS MOUNTING

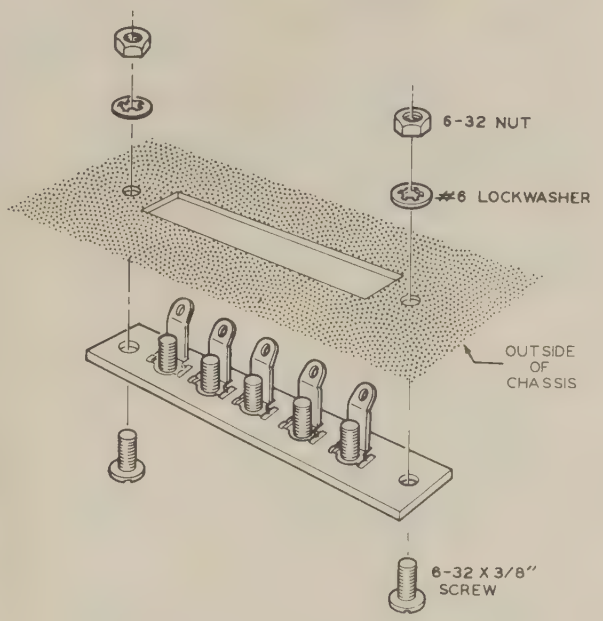
Refer to Pictorial 4 (fold-out from Page 4) for the following steps.

( ) Remove the backing paper from four plastic feet and install one at each location indicated in Detail 4A.

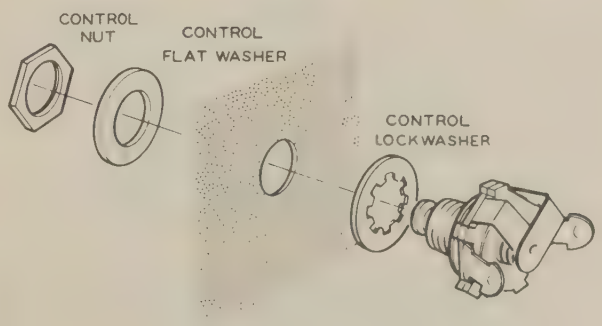
NOTE: When installing the 5-lug screw-type terminal strip, be sure to install it with the lugs positioned as shown.

( ) Refer to Detail 4B and mount the 5-lug screw-type terminal strip at AC on the outside of the chassis. Use two 6-32 x 3/8" screws, #6 lockwashers and two 6-32 nuts.

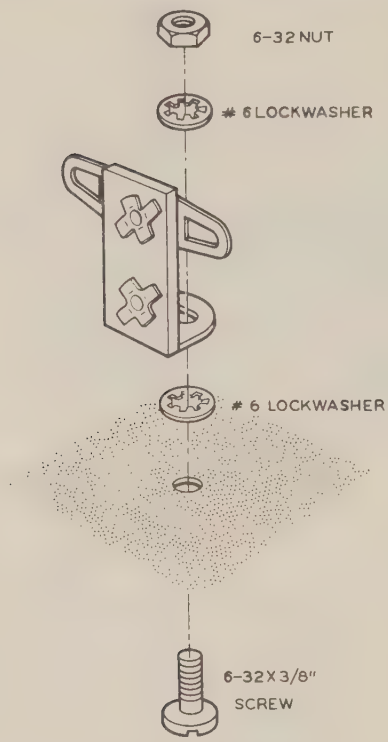
( ) Refer to Detail 4C and mount the pushbutton switch at AD, using a control nut, a control lockwasher, and a flat washer. Position the switch as shown.



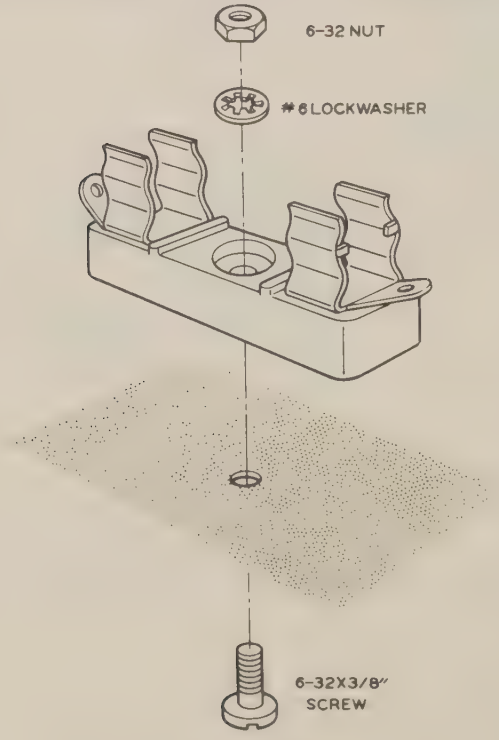
Detail 4B



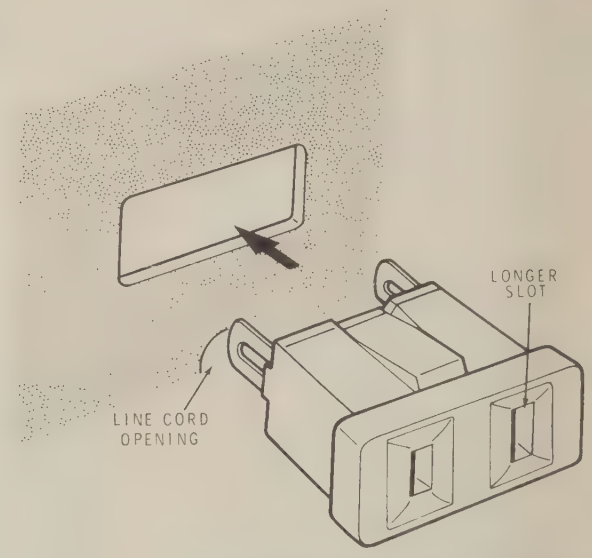
Detail 4C



Detail 4D



Detail 4E



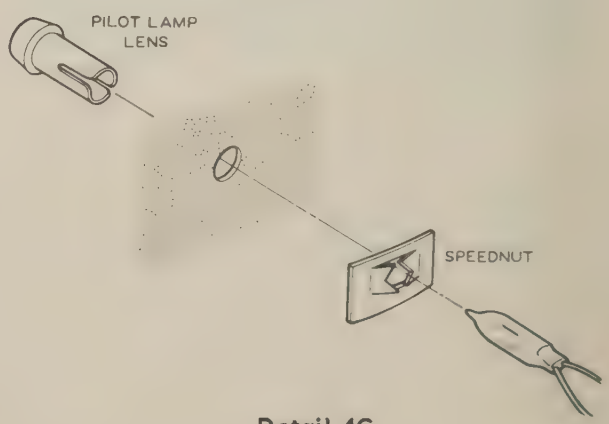
Detail 4F

( ) Mount the 2-lug terminal strip at AE with a 6-32 x 3/8" screw, two #6 lockwashers, and a 6-32 nut. Refer to Detail 4D.

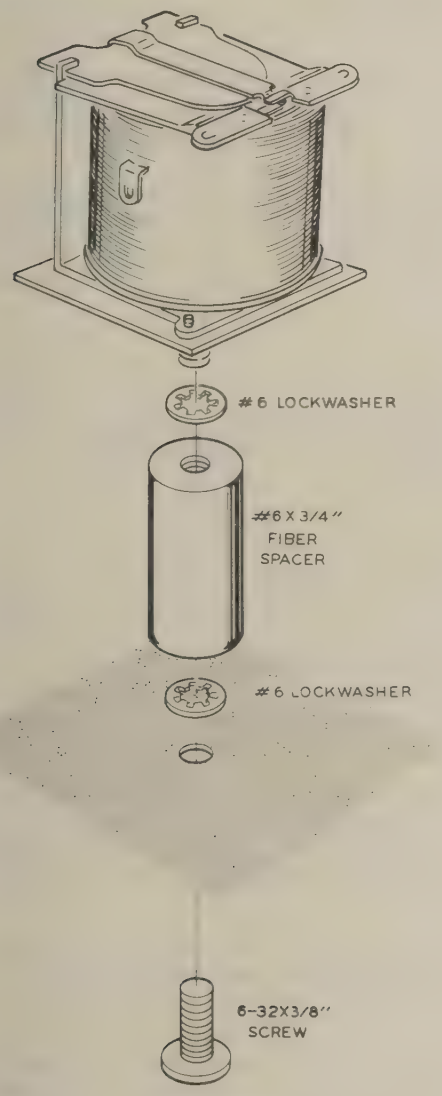
( ) Mount the fuseholder at AF with a 6-32 x 3/8" screw, a #6 lockwasher, and a 6-32 nut as shown in Detail 4E.

( ) Refer to Detail 4F and press the AC socket into place at AG. Note the longer slot and position it as shown.

( ) Refer to Detail 4G and insert the red lens through the chassis at AJ. Push the speednut over the red lens with the concave side toward the chassis plate. Then insert the neon lamp into the back of the lens.



Detail 4G



Detail 4H

( ) Refer to Detail 4H and place a #6 lockwasher over the threaded shaft of the relay. Then install the fiber spacer onto the relay. Do not overtighten it or the spacer could crack.

( ) Mount the relay and spacer at AH with a #6 lockwasher between the spacer and the chassis. Secure with a 6-32 x 3/8" screw. Do not overtighten the screw.

CHASSIS WIRING

Refer to Pictorial 5 (fold-out from Page 4) for the following steps.

( ) Position the circuit board as shown in Pictorial 5. Let the circuit board slant away from the chassis. This will allow you to make the connections more easily.

( ) Connect the black wire from hole B of the circuit board to lug 1 of terminal strip AC (S-1).

( ) Connect the red wire from hole A of the circuit board to lug 2 of terminal strip AC (S-1).

( ) Connect the blue wire from hole C of the circuit board to lug 3 of terminal strip AC (S-1).

( ) Connect the blue wire from hole E of the circuit board to lug 1 of pushbutton switch AD (S-1).

( ) Connect the yellow wire from hole D of the circuit board to lug 2 of pushbutton switch AD (S-1).

( ) Connect the yellow wire from hole G of the circuit board to lug 3 of relay AH (NS).

( ) Connect the black wire from hole F of the circuit board to lug 1 of relay AH (NS).

( ) Connect the red wire from hole K of the circuit board to lug 4 of relay AH (NS).

( ) Connect the black wire from hole J of the circuit board to lug 1 of socket AG (NS).

( ) Connect the red wire from hole H of the circuit board to lug 1 of fuseholder AF (NS).

( ) Place a 1-3/4" length of sleeving over one lead of the neon lamp and connect the lead to lug 4 of relay AH (S-2). Cut off the excess wire length so it does not touch lug 5.

( ) Place a 1-1/4" length of sleeving over the other lead of the neon lamp and connect the lead to lug 1 of terminal strip AE (S-1).

( ) Connect one lead of an 82 kΩ (gray-red-orange) resistor to lug 2 of terminal strip AE (S-1). Connect the other lead to lug 1 of fuseholder AF (S-2).

( ) Prepare the following lengths of hookup wire. Cut each wire to the indicated length and remove 1/4" of insulation from each end.

COLOR	LENGTH
black	1-1/2"
blue	5-1/2"
black	3-3/4"
yellow	3-3/4"

( ) Connect the 1-1/2" black wire from lug 2 of fuseholder AF (S-1) to lug 2 of socket AG (NS).

( ) Connect the 5-1/2" blue wire from lug 2 of relay AH (S-1) to lug 1 of socket AG (NS).

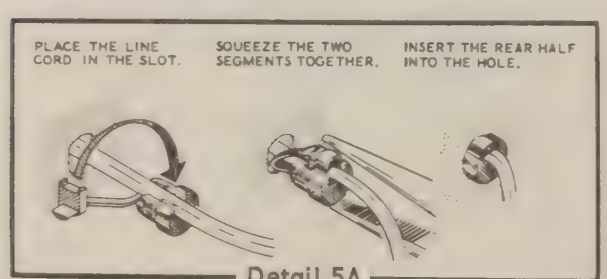
( ) Connect a 3-3/4" black wire from lug 1 of relay AH (S-2) to lug 4 of terminal strip AC (S-1).

( ) Connect a 3-3/4" yellow wire from lug 3 of relay AH (S-2) to lug 5 of terminal strip AC (S-1).

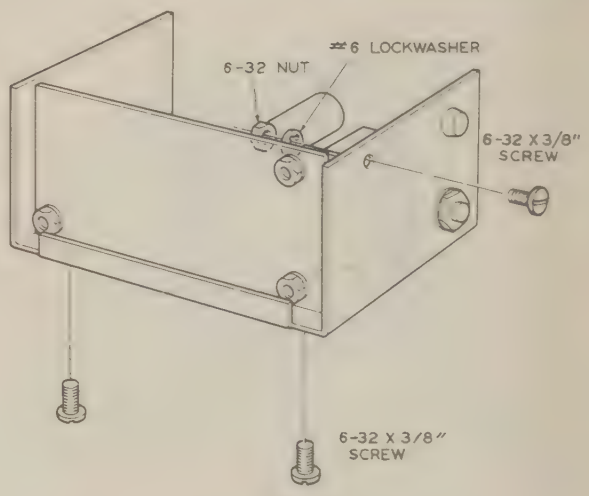
( ) Locate the line cord. At the end of each line cord lead, twist the small wire strands together. Then apply a small mount of solder to each lead to hold the strands in place.

( ) Insert the line cord through hole AK. Note one lead is ribbed and the other is smooth. Connect the ribbed lead to lug 1 (S-3) and the other lead to lug 2 (S-2) of socket AG.

( ) Place the line cord in the strain relief as shown in Detail 5A. Then install the strain relief in hole AK. Refer to the inset drawing in Pictorial 5.



Detail 5A



Detail 5B

( ) Mount the circuit board on the chassis with 6-32 x 3/8" screws as shown in Detail 5B.

( ) Secure the large angle bracket to the top of the chassis with a 6-32 x 3/8" screw, a #6 lockwasher, and a 6-32 nut. Adjust the bracket if necessary.

( ) Install the fuse in fuseholder AF.

( ) Position the wires away from the adjustment screw on the trimmer capacitor and away from the slotted holes in the chassis.

( ) Carefully inspect the Utility Transmitter wiring. In particular, make sure that all connections are properly soldered, and that all component leads are touching only the points to which they are connected. Remove any wire clippings or solder splashes that are lodged in the wiring.

This completes the assembly of your Heathkit Utility Transmitter. The chassis cover will be installed after you complete the Initial Test And Adjustment sections.

INITIAL TEST

Refer to the In Case Of Difficulty section (Page 18) of the Manual if you do not obtain the proper results in any of the following steps.

( ) Adjust trimmer capacitor C3 clockwise until it is snug. Then turn it counterclockwise three-fourths of a turn. Refer to Figure 1.

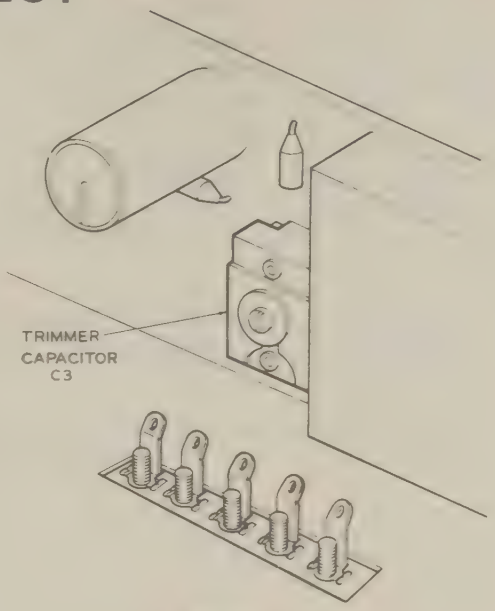


Figure 1

( ) Remove all the insulation from a 1-1/4" length of red wire. Connect this wire between screw terminals 1 and 2 on the back of the chassis as shown in Figure 2.

( ) Plug in and turn on a standard AM radio. Tune it to an unused portion of the dial around 600 kHz.

CAUTION: When the transmitter line cord is connected to an AC wall outlet, 120 volts AC will be present on many wires and terminals in the circuit. Touching any of these points could result in an electrical shock.

NOTE: The wide pin on the transmitter line cord plug will fit only the longer slot of an AC wall outlet.

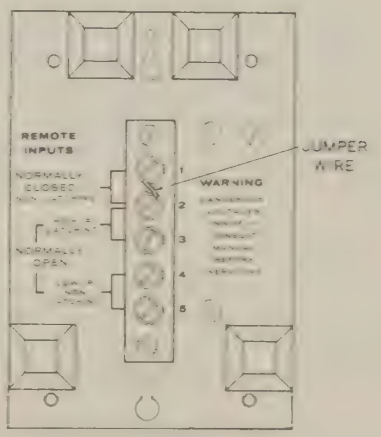
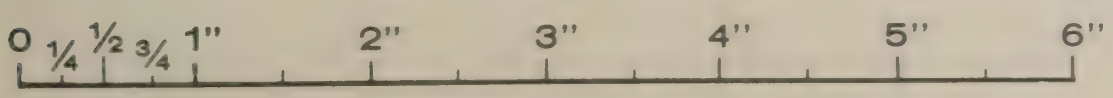


Figure 2

( ) Plug the line cord of the Utility Transmitter into an AC wall outlet. A click should be heard as the relay activates, and the lamp should turn on and then go off quickly.

( ) Push the RESET button and hold it in. The lamp should light and a buzz should be heard from the AM radio. Release the button and remove the AC plug from the wall outlet.

( ) Remove the jumper wire from screw terminals 1 and 2, refer to Figure 2.



( ) Plug the line cord of the Transmitter into the AC wall outlet. The lamp should come on and a buzz should be heard from the radio. Then unplug the Transmitter and replace the jumper wire across terminals 1 and 2.

( ) Plug the line cord of the Transmitter into the AC wall outlet. Then use a screwdriver to short terminals 2 and 3 together. The lamp should light and a buzz should be heard in the radio.

( ) Push and release the RESET button. The lamp should go out and the buzz in the AM radio should stop.

( ) Unplug the transmitter line cord from the AC outlet.

NOTE: The next paragraph is directed only toward those who plan to mount the Transmitter and Home Protection Receiver at some distance from each other (such as between a house and barn, for example).

During the previous steps you adjusted trimmer capacitor C3 for satisfactory operation in most installations. However, if your system works normally when the Utility Transmitter and Home Protection Receiver are near each other but will not operate when they are a long distance apart, you should readjust C3 as described in the Range Adjustments section (Page 22) of the Home Protection Receiver Manual.

Proceed to Final Assembly.

FINAL ASSEMBLY

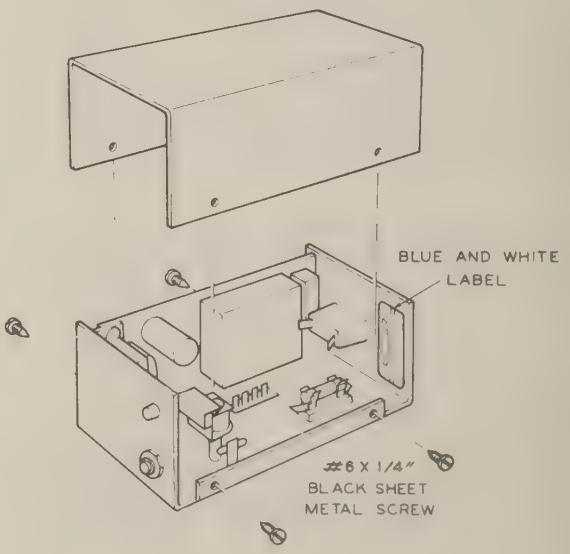
NOTE: The blue and white label that is installed in the next step shows the Model Number and Production Series Number of your kit. Refer to these numbers in any communications you have with the Heath Company about this kit. This assures you of the most complete and up-to-date information in return.

Refer to Pictorial 6 for the following steps.

( ) Carefully peel away the backing paper from the blue and white label. Then press the label onto the inside of the chassis at the location shown in the Pictorial.

( ) Install the chassis cover by sliding it down over the chassis and securing it with four #6 x 1/4" black sheet metal screws.

This completes the assembly of your Heathkit Utility Transmitter.



PICTORIAL 6

APPLICATIONS

This section will help you become more familiar with different types of sensors and tell you how they are used with the Utility Transmitter to achieve the warning protection you desire.

A sensor can be thought of as a switch that is actuated by a temperature change, mechanical linkage, or physical action. Any sensor that produces an open or closed circuit situation when it is actuated can be used to activate the Utility Transmitter.

All normally closed sensors will connect to terminals 1 and 2 on the Utility Transmitter. Normally open sensors will connect to terminals 2 and 3; or, if the sensor is exposed to moisture as in freeze and thaw detection, terminals 4 and 5 are used. If you are in doubt about a sensor, the Installation and Wiring instructions on Page 16 will describe how you can tell if a sensor is normally closed or normally open.

The normally closed sensors, which are connected to terminals 1 and 2 of the Remote Input terminal strip, must have a total resistance of 800 Ω or less. When these types of sensors are activated, their total resistance increases to a value greater than 5000 Ω to trigger the Utility Transmitter.

When high resistance operation is required, normally open sensors with a total resistance of 350 kΩ or more are connected to terminals 2 and 3 of the Remote Input terminal strip. When these types of sensors are activated, their total resistance decreases to a value smaller than 100 kΩ to trigger the Utility Transmitter.

When low resistance operation is required, normally open sensors with a total resistance of 1000 Ω or more are connected to terminals 4 and 5 of the Remote Input terminal strip. When these types of sensors are activated, their total resistance decreases to a value smaller than 100 Ω to trigger the Utility Transmitter.

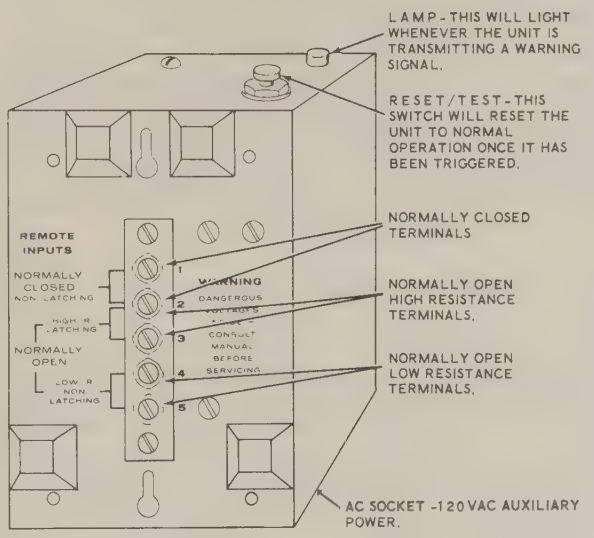


Figure 3

The terms "latching" and "nonlatching" are marked on the rear of the Transmitter chassis to describe the type of operation that occurs at each pair of terminals. The term latching means that once a sensor has activated these terminals (2 and 3), the Transmitter will send out a warning signal to the Receiver until:

1. The condition that caused the warning is corrected.
2. You press the RESET button on the Transmitter.

The term nonlatching means that the warning signal will stop as soon as the condition that caused the warning is corrected. (NOTE: Whenever an alarm sounds, it is also necessary to press the RESET button on the Receiver to place the system back in operation.

SENSOR DEVICES

Fire, freeze warning, cooling, flood, and intrusion alarm sensors are described in the following paragraphs. Refer to the Sensor Application Chart on Page 15 and Figures 4 through 9 (fold-out from Page 17) to see how each of these devices are connected to the Utility Transmitter. If you already know what sensors you will use, you may disregard this information and proceed to the Installation Section.

High Temperature (Fire) Alarm

Thermal switches (heat sensors) can be used to detect excessively high temperatures and activate your Utility Transmitter. Thermostats, which may be either normally open or normally closed, can also be used. A normally closed thermal switch, Model GDA-97-3, is available from the Heath Company; thermal switches and thermostats may be obtained from a heating dealer in your area.

Freeze Alarm

Freeze warnings may be obtained from thermostats that operate at 32 degrees F or less. Some of these are sealed units that operate at a predetermined temperature. Others are adjustable and can be set to the desired operating temperature. This type of thermostat is available from refrigeration dealers.

Cooling-Heating Alarm

Any home heating thermostat can be used as a cooling or heating alarm sensor. These are adjustable and may be set to activate the Utility Transmitter at any temperature within the range of the thermostat. Thermostats may be either normally open or normally closed.

Thaw Alarm

Thaw warnings may be obtained from thermal switches which operate at freezer temperatures. These usually are normally open type switches which close with a rise in temperature. This type of thermal switch is available from refrigeration dealers.

Intrusion Alarm

An intrusion (burglar) alarm can be constructed in many ways. Switch contacts that disconnect, or open, when a door opens for example, will act as an intrusion alarm if wired to the normally closed contacts of the Utility Transmitter. Switch contacts that close when the door opens, will act as an intrusion alarm if wired to the normally open contacts.

The following two switches, which are easily adaptable as window and door switches, are available from the Heath Company:

Model GDA-97-2: A lever-arm-activated microswitch with both normally open and normally closed contacts.

Model GDA-97-1: A magnetic reed switch with magnet. The contacts on this switch are normally closed when the magnet is close to the switch. Moving the switch or the magnet will cause the contacts to open. (See Figure 3A for a typical installation.)

Electronic supply catalogs and dealers carry several types of switches that can be used in intrusion alarm systems, including window switches, door switches, foot treadle switches, and photo electric switches. It is also fairly easy to make your own intrusion alarm switch by connecting both ends of a length of #40 varnished copper wire to the normally closed contacts of the Utility Transmitter. The wire could then be connected across a door or window or used around property perimeters. If this wire were broken, the transmitter would be activated and the alarm would sound in the Receiver.

Flood Alarm

Rising water sensing devices can be obtained, but you can easily construct your own from a line cord in the following manner: Cut the plug off of a line cord and trim one wire so that it is 1/2" shorter than the other. Remove 1/4" of insulation from both wires, and apply a small amount of solder to the end of each wire to hold the small strands together. Suspend these wire ends over the area in danger of flooding at the desired height. Connect the other end of the line cord to the normally open terminals of the Utility Transmitter. When rising water covers the suspended wire ends they will act like a closed switch and cause the Utility Transmitter to become activated.

Sensor Application Chart

NOTE: Normally closed sensors connect to terminals 1 and 2 of the Utility Transmitter. Normally open sensors connect to terminals 2 and 3 and/or 4 and 5. Refer to the fold-out from Page 17.

TYPE OF INSTALLATION	TYPE OF SERVICE	TYPE OF DETECTOR	TYPE OF OPERATION	TERMINAL CONNECTIONS	FIGURE NUMBER
High temperature (fire) Alarm	Home protection	Thermostats which activate with a rise in temperature (typically 133 degrees F).	Normally closed Normally open	1 and 2 4 and 5	5 9
Freeze Alarm	Farming (fruit crops).	Thermostats which activate with a fall in temperature.	Normally closed Normally open	1 and 2 4 and 5	6 9
Cooling-heating Alarm	Farming: 1. Poultry. 2. Livestock. 3. Fruit storage.	Thermostats which activate with a fall or rise in temperature.	Normally closed Normally open	1 and 2 2 and 3	6 7
Thaw Alarm	Home protection. Industrial protection. Freezers.	Thermostats which activate with a rise or fall in temperature.	Normally closed Normally open	1 and 2 4 and 5	6 9
Intrusion (burglar) Alarm	Home protection against burglary.	1. Window switches. 2. Door switches. 3. Treadle foot switches. 4. Fine wire loops. 5. Photo electric switches. 6. Proximity switches. 7. Mercury switches.	Normally closed Normally open	1 and 2 2 and 3	4 7
Flood Alarm	Home protection: 1. Rising water. 2. Bilge or sump pump areas.	1. Electrically separated noncorrosive conductors which are shorted by rising water. 2. Float switches.	Normally open Normally open Normally closed	2 and 3 4 and 5 1 and 2	8 7 6

CAUTION: Sensors connected to the nonlatching terminals must be activated for a period of 5 seconds or more to allow the Transmitter to trigger the Home Protection Receiver.

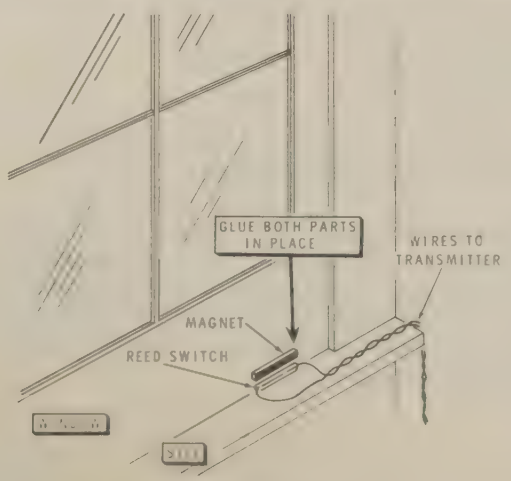


Figure 3-3A

INSTALLATION

PLANNING YOUR INSTALLATION

Plan your installation carefully before you mount or wire any components. Determine where you will mount the Utility Transmitter. Remember that there must not be a power line transformer between the Transmitter and Receiver; if one of these transformers is between the two units, they will not operate properly. (Power line transformers are usually mounted on the power line pole that furnishes the AC power to your residence.)

Determine where you want to mount each sensor and how you will route the wires between the sensors and Transmitter. NOTE: The total resistance of the wires connected to terminals 1 and 2 must not exceed 800 Ω. For example:

WIRE GAUGE	MAXIMUM USABLE LENGTH
#40 copper wire	750 feet
#36 copper wire	2000 feet
#32 copper wire	4000 feet

If larger size wires are used, the 800 Ω resistance will not be critical.

NOTE: The total resistance of wires connected to terminals 4 and 5 must not exceed 100 Ω DC resistance. For example:

WIRE GAUGE	MAXIMUM USABLE LENGTH
#30 copper wire	900 feet
#26 cooper wire	2400 feet
#22 copper wire	1 mile

If larger size wires are used, the 100 Ω resistance will not be critical.

Determine where you will obtain the 120 volts AC power to operate the Utility Transmitter. If there is not an AC outlet within reach of the line cord (8 ft) at the desired location, it would be best to have one installed, since extension cords are not desirable.

INSTALLATION AND WIRING

( ) Mark the location where you intend to mount the Utility Transmitter. Then refer to Figure 10 and, using the dimensions shown, install two #6 x 1-1/2" wood screws in the wall.

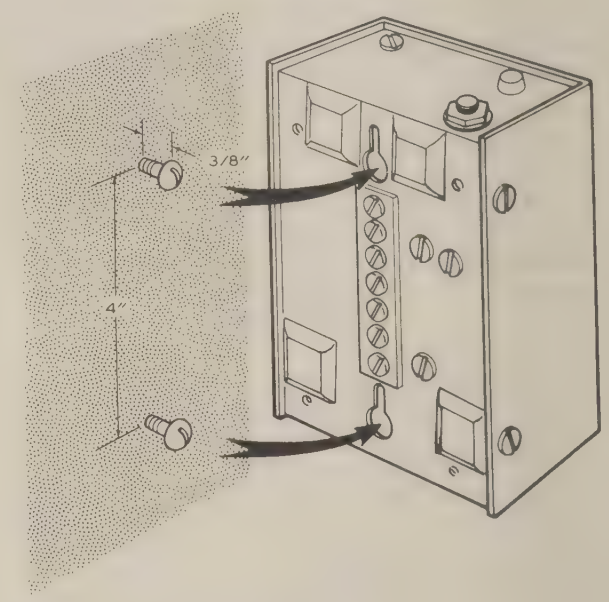


Figure 10

( ) Install each of the sensors at the desired location.

NOTE: If you do not know whether a sensor is normally open or normally closed, temporarily connect it across terminals 4 and 5, and plug in the Transmitter. If the Utility Transmitter lamp lights, the sensor is normally closed. If the lamp does not light, the sensor is normally open.

( ) Wire the sensors to the Utility Transmitter. Connect the normally closed sensors to terminals 1 and 2 as shown in Figures 4, 5, and 6. Connect the normally open sensors to terminals 2 and 3 as shown in Figures 7, 8, and 9.

( ) Mount the Utility Transmitter on the #6 wood screws.

NOTE: Override switches may be used at the sensors or at the Utility Transmitter to disable the alarm system during periods when protection is not necessary. Refer to Figure 11.

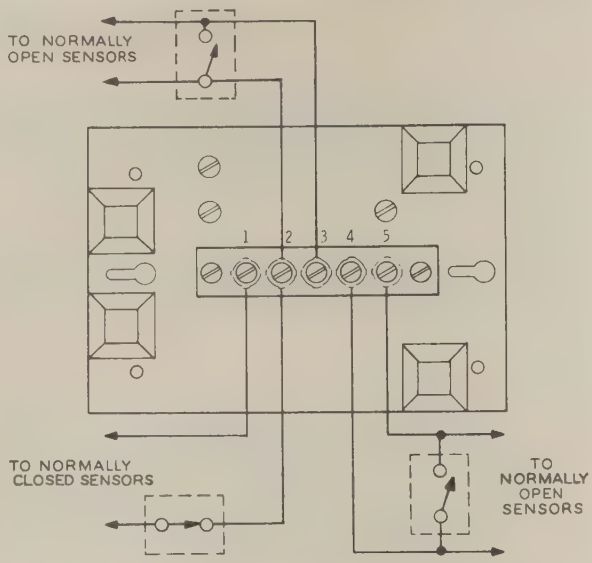
( ) Plug the line cord of the Utility Transmitter into the AC outlet.

NOTE: If you do not intend to use normally closed sensors, install a jumper wire between terminals 1 and 2.

COMMERCIAL AND INDUSTRIAL CONSIDERATIONS

In large commercial and industrial installations it may be necessary to plug in the Home Protection Receiver between the Utility Transmitter and the main power service entrance to the building for optimum performance.

This completes the Installation. NOTE: Be sure to check the operation of your system regularly.



OVERRIDE SWITCHES
(SWITCHES SHOWN IN THE OVERRIDE POSITION)

Figure 11

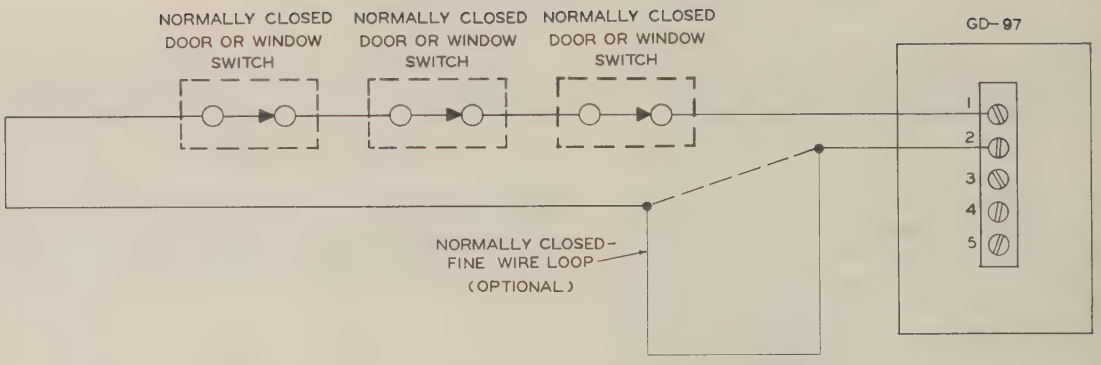


FIGURE 4

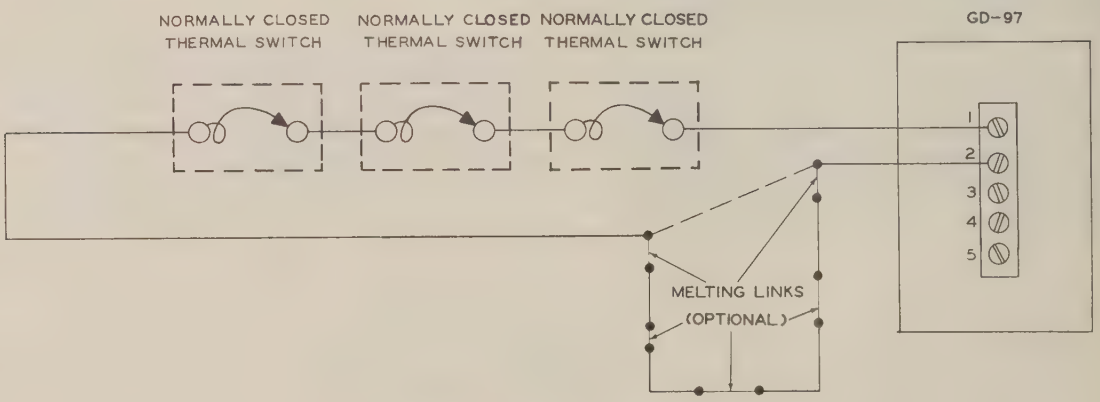


FIGURE 5

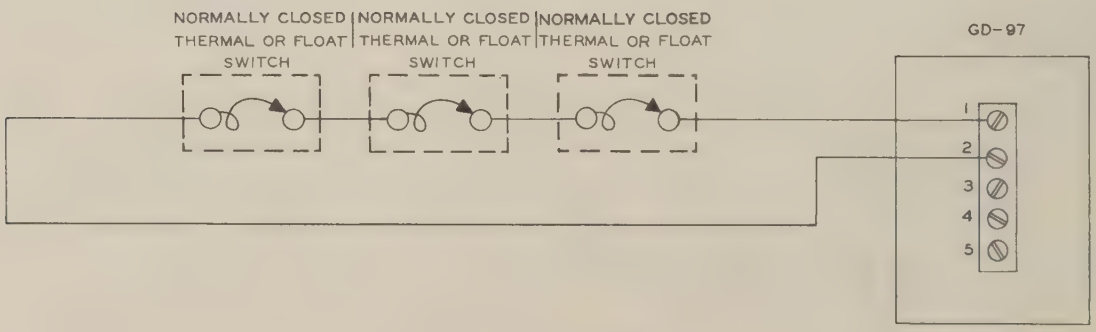


FIGURE 6

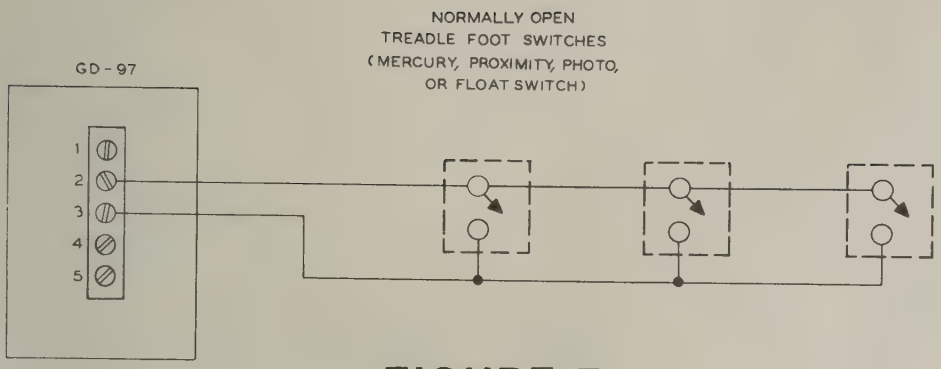


FIGURE 7

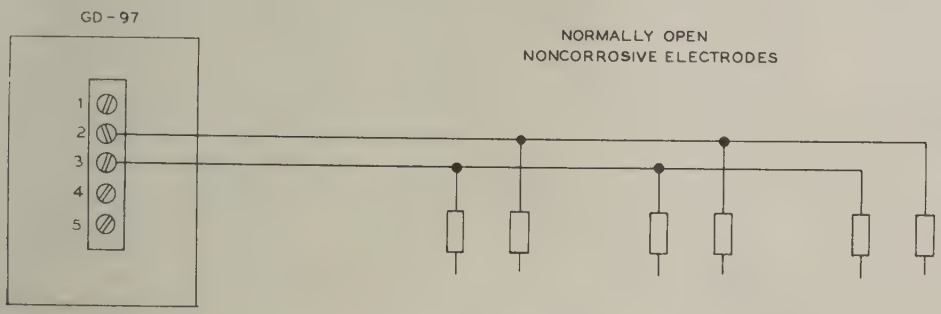


FIGURE 8

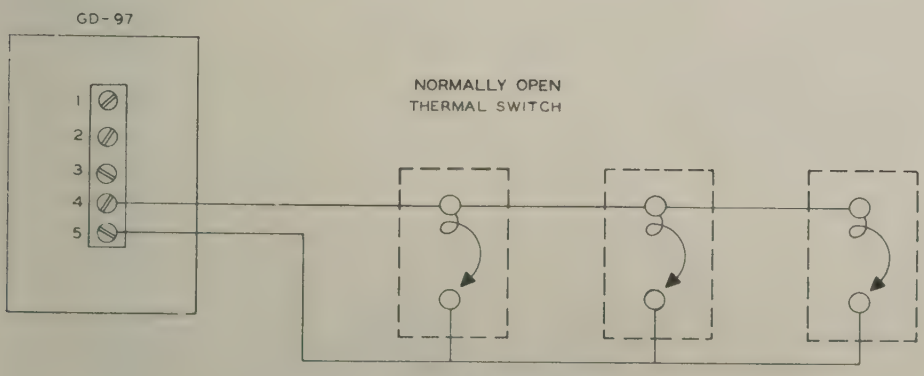


FIGURE 9

IN CASE OF DIFFICULTY

This section of the Manual is divided into the Visual Tests and the Troubleshooting Chart. The Visual Tests are directed primarily toward troubles that occur right after assembly.

Refer to the Service and Warranty sections of the Kit Builders Guide in an extreme case, when you are unable to resolve the difficulty.

VISUAL TESTS

1. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something consistently overlooked by the kit builder.

2. About 90% of the kits that are returned for repair do not function properly due to poor connections and soldering. Therefore, many troubles can be eliminated by reheating all connections to make sure they are soldered as described in the Soldering section of the Kit Builders Guide.

3. Check for bits of solder, solder bridges, wire ends, or other foreign matter which may be lodged in the wiring.

If the trouble is still not located after the Visual Tests are completed and a voltmeter is available, check voltage readings against those shown on the Schematic Diagram (fold-out from Page 23) and Voltage X-Ray View (Page 23). All voltage readings were taken with an 11 megohm input voltmeter. Voltages may vary as much as ±20%. All voltage readings are taken from terminal 3 on the relay to the point indicated.

It is a good safety practice to use an isolation transformer when making measurements to the Utility Transmitter, since several circuit board connections are at AC line potential with respect to earth ground. Refer to Figure 12.

NOTE: In an extreme case where you are unable to resolve a difficulty, refer to the Service and Warranty sections of the "Kit Builders Guide", and to the "Factory Repair Service" information on fold-out from Page 24 of this Manual.

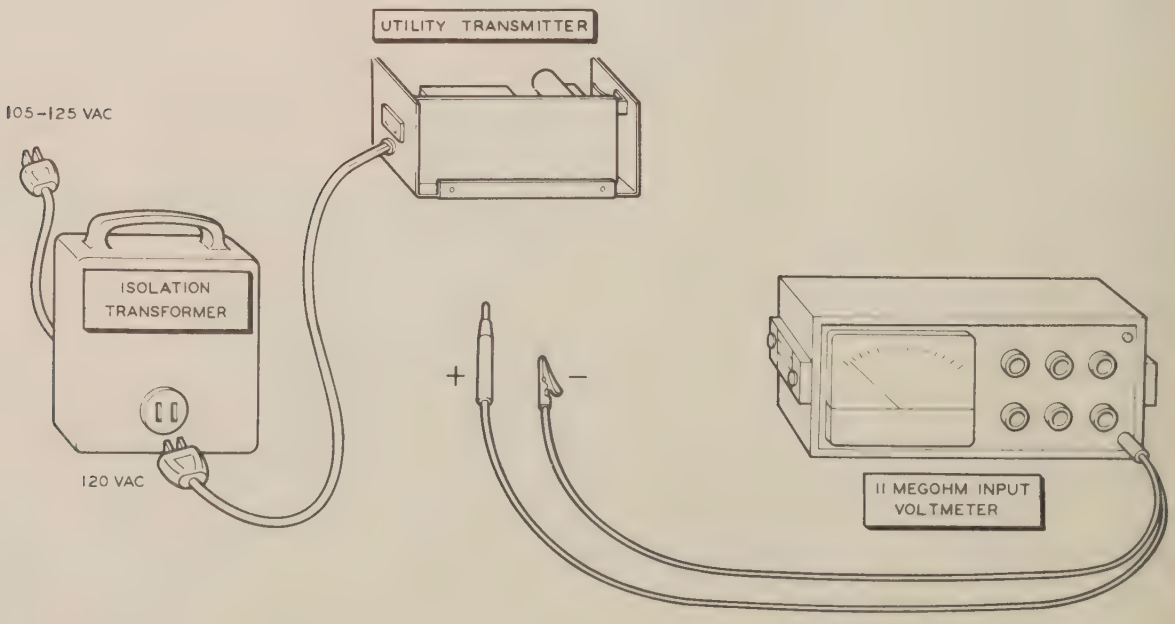


Figure 12

Troubleshooting Chart

DIFFICULTY	POSSIBLE CAUSE
Relay does not activate (lamp off).	1. Line cord not plugged in. 2. Defective fuse. 3. Incorrect wiring.
Relay does not activate (unit will not stop transmitting - lamp on).	1. Incorrect wiring. 2. Terminals 1 and 2 not jumpered. 3. Terminals 2 and 3 or 4 and 5 shorted. 4. C1 open or shorted. 5. D1 open, shorted, or installed backwards. 6. D2 shorted. 7. Power transformer open. 8. Reset/Test switch shorted. 9. Defective relay.
Lamp does not light when Reset/Test switch is pushed.	1. Incorrect wiring. 2. Contacts on Reset switch not making connection when the switch is pushed. 3. Relay contacts not making connection. 4. R4 open. 5. Neon lamp defective.
Unit does not transmit when jumper wire across terminals 1 and 2 is removed.	1. Incorrect wiring. 2. Short in wiring at terminal strip.
Unit does not transmit when terminals 2 and 3 are shorted.	1. Incorrect wiring. 2. R2 open. 3. D2 open or installed incorrectly. 4. C2 shorted or leaky.
Unit appears to operate properly, but does not transmit a signal to the Home Protection Receiver, or AM radio. (Lamp on.)	1. Incorrect wiring. 2. D3 open or installed backwards. 3. R4 open. 4. Transmitter module defective.
C3 has no effect during alignment.	1. C3 open. 2. Improper receiver alignment. 3. Transmitter module defective.

SPECIFICATIONS

Remote Inputs	
Terminals 1 and 2.	Normally closed, nonlatching.
Terminals 2 and 3.	Normally open, latching.
Terminals 4 and 5.	Normally open, nonlatching.
Remote Input Resistance (Total resistance of wire and sensors)	
Terminals 1 and 2.	Untriggered: 800 Ω or less. Triggered: 5000 Ω or more.
Terminals 2 and 3.	Untriggered: 350 kΩ or more. Triggered: 100 kΩ or less.
Terminals 4 and 5.	Untriggered: 1000 Ω or more. Triggered: 100 Ω or less.
Operating Frequency.	50 kHz.
Sensors.	This Transmitter may be used with either momentary action or continuous action sensor contacts at terminals 2 and 3. Terminals 1 and 2 and 4 and 5 require a sensor that will be activated for a period of 5 seconds or more.*
Controls.	Reset/Test. Frequency adjustment.
Panel Connections.	Remote Inputs for sensors. 120 VAC socket.
Power Requirements.	105 to 125 volts AC. 50/60 Hz.
Standby Power.	.7 watts.
Transmit Power.	7 watts.
Cabinet Size.	3-11/16" x 2-5/8" x 5-3/8".
Color.	Brown and Beige.
Net Weight.	1.5 lbs.

*Five seconds is the time necessary for the Home Protection Receiver to respond to a transmitted signal.

The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligation to incorporate new features in products previously sold.

CIRCUIT DESCRIPTION

The Utility Transmitter circuitry consists of a 50 kHz transmitter that can be triggered by sensors (switches) connected across normally open or normally closed input terminals. The Transmitter will also be activated by certain component failures in the transmitter power supply, which de-energize the relay and cause a warning signal to be sent to the Home Protection Receiver. When the normally open or normally closed input terminals are triggered, the relay de-energizes and turns on the transmitter by supplying it with a half-wave rectified operating voltage from the AC power line. The transmitter produces a 50 kHz signal that is coupled through the AC power line to the Receiver.

Each section of the Utility Transmitter is explained separately to help you understand its operation. Refer to the Schematic Diagram and the Block Diagram (Figure 13) while reading this Circuit Description.

TRANSMITTER

The transmitter circuits consist of a 50 kHz astable multivibrator (Q101 and Q102) and a high-power switching transistor (Q103) which are contained for the most part in a transmitter module. These circuits receive operating voltage during the positive half cycle of the 120 volt AC power line through diode D3.

The 50 kHz multivibrator frequency is determined in the multivibrator by resistors R103 and R104, capacitors C101 and C102, and Frequency trimmer capacitor C3. Trimmer capacitor C3 is used for making transmitter frequency adjustments.

The 50 kHz signal is coupled from the collector of Q102 to the base of transistor Q103 by capacitor C103 and resistor R106. Resistor R107 serves as a voltage divider to protect the base of Q103 from voltage overload.

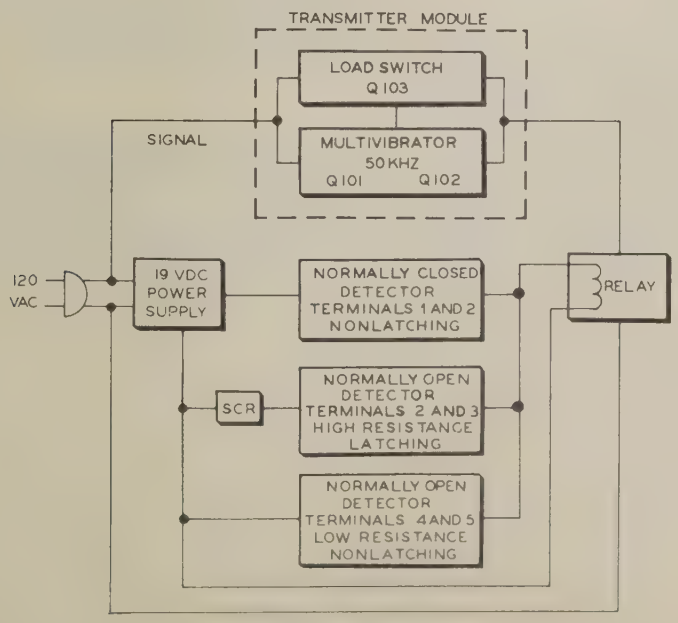


Figure 13

The signal from Q102 causes Q103 to switch off and on at a 50 kHz rate. When the transistor is on, the collector and emitter appear as a short, placing resistor R4 and capacitor C104 across the power line. This resistor and capacitor act as nonlinear loads for the transistor.

Transistor Q103 continues to switch at a 50 kHz rate only during the positive half cycle of the line voltage. This switching repeatedly places resistor R4 and capacitor C104 across the power line, which results in a 50 kHz change in the current flow through the power line. The changing current developes a 50 kHz signal voltage that is pulse modulated by the 60 Hz line voltage. The 50 kHz modulated signal is then transmitted through the power line to the Home Protection Receiver.

TRIGGER CIRCUITS

DC power is supplied to the circuit through a half-wave rectifier circuit consisting of transformer T1, diode D1, and capacitor C1. DC current then flows through a normally closed sensor connected to terminals 1 and 2 of the Remote Input terminal strip, through current limiting resistor R1, and finally through the coil of the relay, causing it to energize.

When the relay energizes, contacts 2 and 4 are opened. If a sensor connected across terminals 1 and 2 should open, the relay de-energizes and contacts 2 and 4 close, allowing AC current to pass. Diode D3 then rectifies the AC voltage, changing it to pulsating DC voltage, which is applied to the transmitter module. The transmitter then produces a 50 kHz signal that is coupled through the AC line to the Receiver.

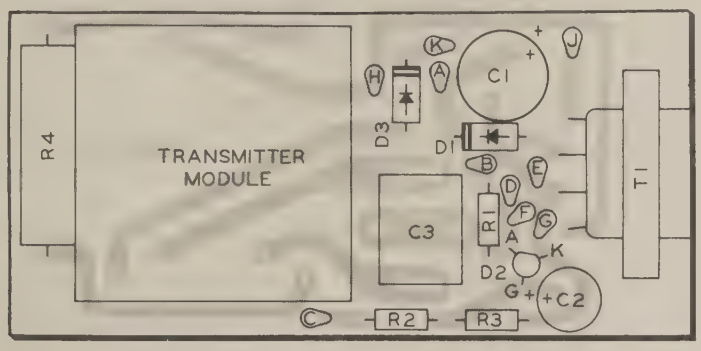
SCR (silicon controlled rectifier) D2 is connected across the relay windings. During normal operation, the SCR offers a high resistance path, so that current flows through the relay coil. When a normally open sensor across terminals 2 and 3 of the Remote Input terminal strip closes, a positive voltage from the power supply, limited by resistor R2, is applied to the gate of the SCR. This positive voltage causes the SCR to conduct, lowering its resistance. This shorts out the relay, causing it to de-energize. Capacitor C2 bypasses static charges, which might falsely trigger the SCR. Resistors R2 and R3 serve as a voltage divider.

Once the SCR has been triggered, the circuit is latched so that the relay remains de-energized, and the SCR remains conducting until the current flowing from its cathode to anode has been removed. The SCR is reset and the circuit is unlatched by the Reset/Test switch which, when pressed, places a short across the SCR. Once the circuit has been reset, the SCR will remain in a nonconducting state until triggered again.

The Reset/Test switch is also connected across relay coil. When the switch is pressed, it shorts out the relay coil, causing it to de-energize. Resistor R1 then acts as a protective load on the half-wave rectifier circuit.

When the relay de-energizes, AC current is also coupled through relay contacts 2 and 4 to the neon lamp and current limiting resistor R5. Therefore, the neon lamp lights whenever the relay de-energizes and the transmitter operates.

CIRCUIT BOARD X-RAY VIEW
(VIEWED FROM FOIL SIDE)

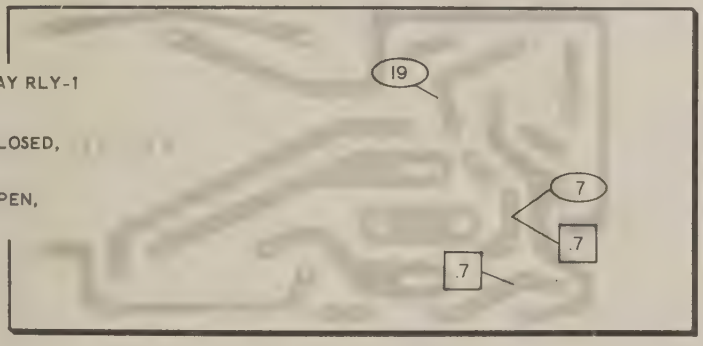


VOLTAGE CHART

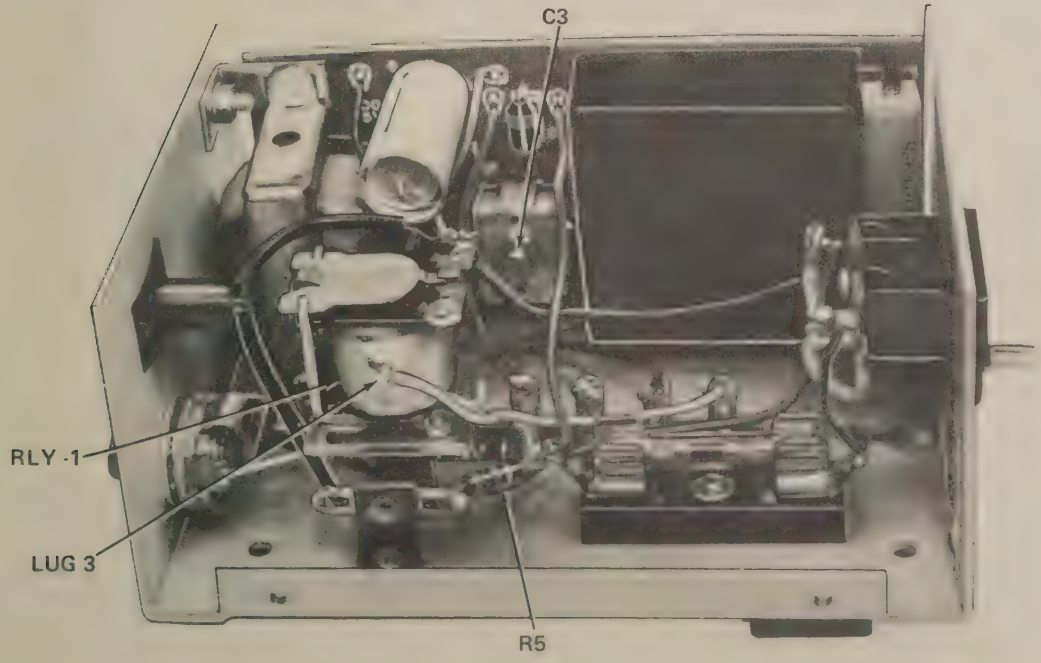
MAKE ALL VOLTAGE MEASUREMENTS FROM LUG 3 ON RELAY RLY-1 TO POINT INDICATED ON CIRCUIT BOARD.

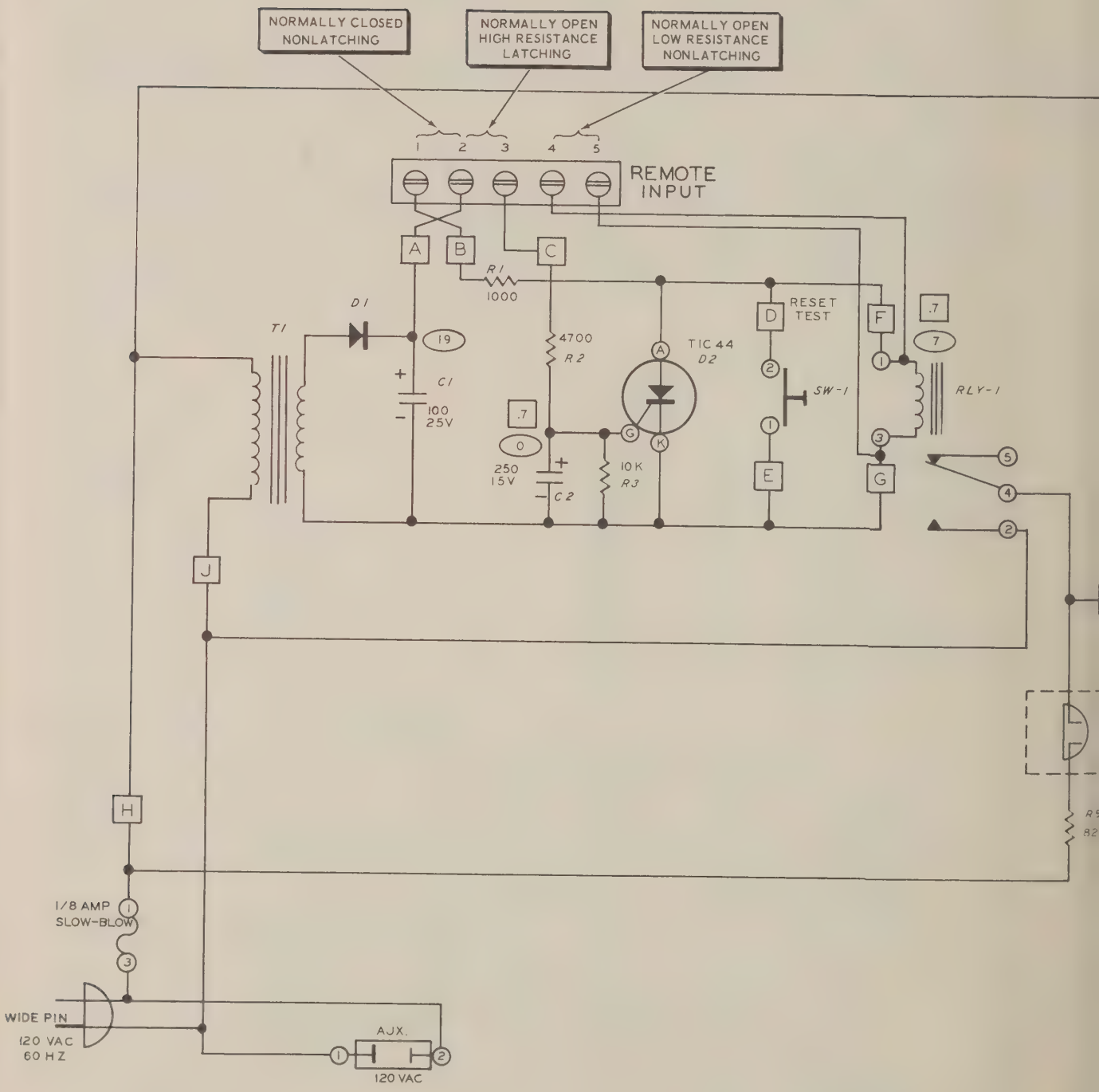
VOLTAGE MEASUREMENTS WITH TERMINALS 1 AND 2 CLOSED, 2 AND 3 OPEN, 4 AND 5 OPEN.

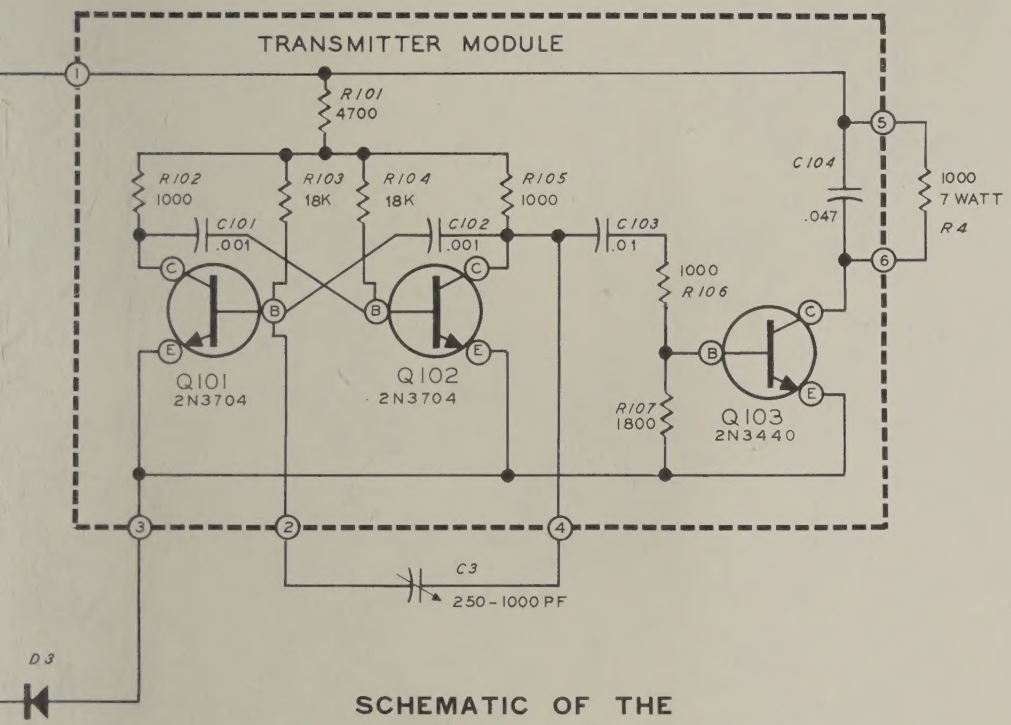
VOLTAGE MEASUREMENTS WITH TERMINALS 1 AND 2 OPEN, 2 AND 3 CLOSED, 4 AND 5 OPEN.



CHASSIS PHOTOGRAPH




NORMALLY CLOSED NONLATCHING
NORMALLY OPEN HIGH RESISTANCE LATCHING
NORMALLY OPEN LOW RESISTANCE NONLATCHING
1 2 3 4 5
REMOTE INPUT
A
B
C
R1
1000
D1
T1
19
C1
100
25V
4700
R2
.7
0
250
15V
C2
10K
R3
TIC 44
D2
D
RESET
TEST
SW-1
E
F
.7
7
RLY-1
G
5
4
2
J
H
1/8 AMP
SLOW-BLOW
1
3
WIDE PIN
120 VAC
60 HZ
AUX.
1
2
120 VAC



SCHEMATIC OF THE HEATHKIT® UTILITY TRANSMITTER MODEL GD-97

1. ALL RESISTORS ARE 1/2 WATT 10% UNLESS OTHERWISE MARKED.
2. ALL CAPACITORS ARE IN μF UNLESS OTHERWISE MARKED.
3. ALL VOLTAGES ARE MEASURED WITH AN 11 MEGOHM INPUT VOLTMETER AND ARE MEASURED FROM LUG 3 OF THE RELAY TO TEST POINT. VOLTAGES MAY VARY AS MUCH AS ±20%.
4. TERMINALS 1 AND 2 ARE NORMALLY CLOSED AND WILL TRIGGER UNIT IF SUBJECTED TO AN OPEN CIRCUIT OF 5000 OHMS OR MORE. TERMINALS 2 AND 3 ARE NORMALLY OPEN, AND WILL TRIGGER UNIT IF SUBJECTED TO A CLOSED CIRCUIT OF 100 K OHMS OR LESS. TERMINALS 4 AND 5 ARE NORMALLY OPEN AND WILL TRIGGER THE UNIT IF SUBJECTED TO A CLOSED CIRCUIT OF 100 Ω OR LESS.
5. UNIT WILL RESET WHEN RESISTANCE ACROSS TERMINALS 1 AND 2 IS 800 OHMS OR LESS. UNIT WILL RESET WHEN RESISTANCE ACROSS TERMINALS 4 AND 5 IS 1 K OHM OR MORE.
6. ⬭ VOLTAGE MEASUREMENTS WITH TERMINALS 1 AND 2 CLOSED, 2 AND 3 OPEN, 4 AND 5 OPEN.
   ☐ VOLTAGE MEASUREMENTS WITH TERMINALS 1 AND 2 CLOSED, 2 AND 3 CLOSED, 4 AND 5 OPEN.
7. STANDBY POWER .7 WATTS.
   TRANSMIT POWER 7 WATTS.

REPLACEMENT PARTS PRICE LIST

To order a replacement part, use the Parts Order Form furnished with this kit. If one is not available, see "Replacement Parts" inside the rear cover of the Manual.

The following prices apply only on purchases from the Heath Company where shipment is to a U.S.A. destination. Add 10% (minimum 25 cents) to the price when ordering from a Heathkit Electronic Center to cover local sales tax, postage, and handling. Outside the U.S.A. parts and service are available from your local Heathkit source and will reflect additional transportation, taxes, duties, and rates of exchange.

PART No.	PRICE Each	DESCRIPTION
RESISTORS		
1-9	.10	1000 Ω
1-16	.10	4700 Ω
1-20	.10	10 kΩ
1-102	.10	82 kΩ
3-15-7	.15	1000 Ω 7 watt
CAPACITORS		
25-160	.55	250 μF electrolytic
25-194	.50	100 μF electrolytic
31-49	.85	250-1000 pF trimmer
DIODES		
57-27	.60	Silicon diode
57-50	1.50	Silicon controlled rectifier
FUSEHOLDER-TERMINAL STRIPS-SOCKET		
422-1	.25	Fuseholder
431-1	.10	2-lug terminal strip
431-17	.15	5-lug screw-type terminal strip
434-147	.20	AC socket
METAL PARTS		
90-399	.80	Chassis
90-400-1	.70	Chassis cover
204-9	.10	Small angle bracket
204-240	.10	Large angle bracket

PART No.	PRICE Each	DESCRIPTION
ELECTRICAL		
54-156	1.50	Power transformer
89-45	.55	Line cord
150-21	16.15	50 kHz transmitter module
64-7	.90	SPST pushbutton switch
69-71	3.40	DPST relay
412-15	.15	Neon lamp
421-26	.30	1/8 ampere slow-blow fuse
HARDWARE		
250-369	.05	#6 x 1/4" black screw
250-89	.05	6-32 x 3/8" screw
250-388	.10	#6 x 1-1/2" wood screw
252-3	.05	6-32 nut
252-7	.05	Control nut
252-32	.05	Speednut
254-1	.05	#6 lockwasher
253-10	.05	Flat washer
254-4	.05	Control lockwasher
255-42	.30	Fiber washer
261-28	.05	Plastic foot
WIRING - SLEEVING		
344-50	.05/ft	Black wire
344-52	.05/ft	Red wire
344-54	.05/ft	Yellow wire
344-56	.05/ft	Blue wire
346-1	.05/ft	Sleeving
MISCELLANEOUS		
413-10	.10	Red lens
85-255-1	1.20	Circuit board
75-24	.10	Line cord strain relief
490-5	.10	Nut starter
331-6	.15	Solder
	2.00	Manual (See front cover for part number.)

CUSTOMER SERVICE

REPLACEMENT PARTS

If you need a replacement part, please fill in the Parts Order Form that is furnished and mail it to the Heath Company. Or, if you write a letter, include the:

- **Part number** and **description** as shown in the **Parts List.**
- Model number and Series number from the blue and white label.
- Date of purchase.
- Nature of the defect.

Please do not return parts to the factory unless they are requested. Parts that are damaged through carelessness or misuse by the kit builder will not be replaced without cost, and will not be considered in warranty.

Parts are also available at the Heathkit Electronic Centers listed in your catalog. Be sure to provide the Heath part number. Bring in the original part when you request a warranty replacement from a Heathkit Electronic Center.

NOTE: Replacement parts are maintained specifically to repair Heathkit products. Parts sales for other reasons will be declined.

TECHNICAL CONSULTATION

Need help with your kit? . . . . Self-Service? . . . . Construction? . . . . Operation? . . . . Call or write for assistance. You'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number and Series number from the blue and white label.
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.

Also include switch positions, connections to other units, operating procedures, voltage readings, and any other information you think might be helpful.

Please do not send parts for testing, unless this is specifically requested by our Consultants.

Hints: Telephone traffic is lightest at midweek. . .please be sure your Manual and notes are on hand when you call.

Heathkit Electronic Center facilities are also available for telephone or "walk-in" personal assistance.

REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.)

If it is convenient, personally deliver your kit to a Heathkit Electronic Center. For warranty parts replacement, supply a copy of the invoice or sales slip.

If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit C.O.D. for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. (Do not include any wooden cabinets or color television picture tubes, as these are easily damaged in shipment.) Place the equipment in a strong carton with at least THREE INCHES of *resilient* packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions (control sticks, large knobs, etc.). If the unit weighs over 15 lbs., place this carton in another one with 3/4" of packing material between the two.

Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

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Benton Harbor, Michigan 49022

HEATH

Schlumberger

MP MASTER

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